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# ***JPRS Report***

## **Science & Technology**

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***USSR: Electronics &  
Electrical Engineering***

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# Science & Technology

## USSR: Electronics and Electrical Engineering

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22 March 1989

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UDC 621.391.01

**Dynamics of Digital Phase-Lock System**

*18600125f Moscow RADIOTEKHNika I  
ELEKTRONIKA in Russian Vol 33 No 5, May 88  
(manuscript received 11 Apr 85, after correction  
3 Dec 86) pp 999-1007*

[Article by V. P. Maksakov]

[Abstract] A digital phase-lock system with an N-before-M filter is considered, such a filter consisting of two counters in which the respective codes  $z^{+}$  and  $z^{-}$  are 0,1,...,N before one counter in which the code is 0,1,...,M (M not smaller than N and not larger than 2N). The dynamical characteristics of this system are evaluated on the basis of a mathematical model which yields the changes in phase and codes  $z^{+}$ ,  $z^{-}$  during a quantization period. The two equations of this model map the phase space onto itself as a sequence of points on trajectories representing displacements of a finite number of segments, a rotational trajectory representing the map of a circle onto itself. The phase-lock range and the length of the transient period, also the characteristics of quantization noise, are determined following a qualitative analysis of those trajectories and of the iterative mapping process. Figures 2; references 15: 14 Russian, 1 Western.

UDC 621.391.01

**Distribution of Envelope Embracing Mixture of Signal and Interference**

*18600125i Moscow RADIOTEKHNika I  
ELEKTRONIKA in Russian Vol 33 No 5, May 88  
(manuscript received 30 Jan 86) pp 1081-1083*

[Article by V. D. Rubtsov and A. A. Koptsev]

[Abstract] Detection of a signal appearing at a narrow-band receiver together with an interference is evaluated, assuming a harmonic signal and an arbitrary distribution of the mixture envelope. Phase and envelope of the interference are assumed to be statistically independent and the phase to be uniformly distributed. The distribution of the mixture envelope is then geometrically represented as a probability of coincidence and, in the first approximation, as the probability of simultaneous occurrence of two events. The initial segments of the corresponding probability density distribution of signal and interference mixture are calculated for a normally distributed interference and for an atmospheric interference according to the Hall model. The relations become much simpler in the case of a large signal-to-interference ratio within the high-frequency receiver passband. Figures 2; references 7: 4 Russian, 3 Western.

UDC 621.31:658.516:621.396.712.3

**Problems of Standardizing Consumption of Electric Energy in Radio and Television Centers**  
18600127d Moscow *TEKHNIKA KINO I*  
*TELEVIDENIYA* in Russian No 5, May 88 pp 46-51

[Article by K. O. Zagorovskiy, G. S. Gintsberg, L. F. Kolarova, G.A. Musin, and Ye. S. Uakin]

[Abstract] An attempt to standardize the consumption of electric energy in radio and television centers is made by using the system approach with the aid of a mathematical model which describes both technology and economics of broadcasting. This model includes a correlation matrix whose evaluation involves a significance test of performance indicators for the purpose of information compression by grouping of parameters into factors and by automatic multidimensional classification. The two composite factors in the thus simplified mathematical model characterize the production-technical capability of a center and the climatological-geophysical features of its location respectively. Such a model is constructed for radio and television centers in the RSFSR. A regression analysis of this model yields 381 kW.h per nominal broadcasting hour. Tables 5; references 11: 10 Russian, 1 Western.

UDC 681.7.067.397.132

**Effect of Chromatic Aberrations in Large-Magnification Zoom Lenses on Quality of Color Television Image**  
18600127b Moscow *TEKHNIKA KINO I*  
*TELEVIDENIYA* in Russian No 5, May 88 pp 18-21

[Article by V. I. Artishevskiy and I. Ye. Sovz, All-Union Scientific Research Institute of Television]

[Abstract] Chromatic aberrations in new large-magnification zoom lenses for television transmitter cameras are evaluated analytically and, those in the OTsT 35x13P lens for KT-178 cameras numerically, for a determination of their effect on the color image. According to theory, with a compound lens whose components are made of at least two different glasses such as crown and flint it is possible to superpose light rays of only two different colors (wavelengths) at one focal point in the plane of the image by adjusting the focal lengths of the component lenses. Light rays of other colors (wavelengths) will not meet at this point, however, and the magnitude of their deviation from that point depends on the focal length of the compound lens, increasing more than linearly with an increase of the latter and the deviation of blue light being larger than the deviation of red light. On this basis has been calculated the geometrical incongruity of the individual, R,G,B images as a function of the focal length of an optomechanically controlled zoom lens. The results are correlated with the

0373 test table depicting standard permissible geometrical separation of the three individual color images. Figures 4; references 5: 2 Russian, 3 Western.

UDC 654.197:006

**Television Broadcasting Systems and Standards**  
18600127c Moscow *TEKHNIKA KINO I*  
*TELEVIDENIYA* in Russian No 5, May 88 pp 43-45

[Article by D. P. Brilliantov, All-Union Scientific Research Institute of Television and Radio Broadcasting]

[Abstract] The technical characteristics of worldwide national television broadcasting standards D.K, B.G, M, N, KI, H, I, L are tabulated for technicians' convenience. The parameters include not only frequency band and number of channels as well as lower and upper corner frequencies, video and audio carrier frequencies, but also wave band and frame-line format as well as video channel and audio channel frequency characteristics. Tables 2.

**Magnetic Video-Tape Recorders for Consumer Market**

18600127e Moscow *TEKHNIKA KINO I*  
*TELEVIDENIYA* in Russian No 5, May 88 pp 56-58

[Article by A. S. Shapiro and F. R. Bushanskiy]

[Abstract] The design of magnetic video-tape recorders now available on the consumer market is described, following a review of the principles of magnetic tape recording and applicable SECAM specifications. The principal three components of such a recorder are the tape, the tape winding mechanism, and a set of heads on a rotating drum. The layout of a video-tape recorder is compared with that of a sound tape recorder, the essential difference being the rotating set of heads instead of a stationary one. The recording format is correlated with the structure of the television image and with the structure of the video signal. Controlled switching of signals for playback and complete reconstruction of a signal for playback are shown schematically. Figures 8.

**Compressor of Speech Signal**

18600129a Moscow *RADIO* in Russian No 5, May 88 pp 22-23

[Article by G. Shulgin, Moscow]

[Abstract] A compressor for lowering the peak factor of a single-sideband speech signal is described which consists of a signal shaper, and amplifier-limiter, and a detector. The limiter operates in the soft mode. The compressor is designed for operation with a separate 9-15 V power supply, drawing a current of up to 20 mA. It is put together on a 100x100 mm<sup>2</sup> square printed-circuit board. Standard MLT or MT fixed resistors and SP-16VA-0.25W adjustable ones must be used, use of other types requiring corrective adjustment of the printed-circuit board. The compressor is enclosed in a housing made of 0.5 mm thick sheet of soft steel. Figures 3.

UDC 621.391.82.01

**Multidimensional Model of Ultralow-Frequency Atmospheric Interference and Its Use for Detection of Radio Signals**

*18600125e Moscow RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 33 No 5, May 88  
(manuscript received 24 Sep 86) pp 980-985*

[Article by B. A. Khadzhi, D. S. Dobrak, and Ye. A. Vershinin]

[Abstract] A multidimensional model of ultralow-frequency atmospheric interference is constructed as an extension of its one-dimensional model and accordingly as the product of a process with a yet to be determined probability density by more than one Gaussian processes with zero means and nonzero dispersions. On the basis of such a model is then constructed as asymptotically optimum algorithm for calculating the signal-to-noise ratio in the radio detector. With the envelope of atmospheric interference represented as a log normal, its signal masking ability as well as the detector efficiency are evaluated, as functions of the exponent in the interference distribution function, for a radio signal with random phase in the presence of such an atmospheric interference. The signal-to-noise ratio be highest when three-dimensionality of the interference distribution has been taken into consideration. Figures 5; references: 6 Russian.

UDC 537.874.2.01

**Scattering of Long Electromagnetic Waves and Integral Characteristics of Scatterer**

*18600125a Moscow RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 33 No 5, May 88  
(manuscript received 29 Jan 86) pp 909-914*

[Article by V. M. Babich]

[Abstract] The problem of scattering is solved for long electromagnetic waves impinging on a metallic body, on the assumption that both electric and magnetic field vectors of the scattered wave satisfy the conditions of radiation at infinity as well as the classical boundary condition at the body surface. The corresponding Maxwell equations are reduced to a recurrent system of vector equations. As an aid to its solution are considered the two-dimensional Neumann problem and the three-dimensional Dirichlet problem for the exterior of a finite body. The solution on this basis yields expressions for the two wave field vectors in terms of the dipole tensor and the polarization tensor, both of which characterize the scatterer. These expressions are normalized to unity dielectric permittivity and magnetic permeability. In the case of a plane wave scattered by a cylinder with arbitrary cross-section the problem reduces to both Neumann and Dirichlet problems for the Helmholtz equation, its asymptotic solution revealing a dependence of

the parameters of a scattered wave on the Wiener capacitance of the exterior region as well as on components of the dipole tensor. The author thanks S. A. Nazarov for helpful consultations. References 7: 4 Russian, 3 Western (1 in Russian translation).

UDC 537.874.6.01

**Peculiarities Characterizing Reflection of Electromagnetic Waves by Dielectric Body with Periodic Structure**

*18600125b Moscow RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 33 No 5, May 88  
(manuscript received 19 May 86) pp 915-921*

[Article by G. Ye. Zilberman, B. I. Makarenko, G. F. Goltvyanskaya, and A. Yu. Darzhaniya]

[Abstract] Partial reflection of electromagnetic waves by a dielectric body with a periodic structure is analyzed theoretically and a band-elimination interference filter is synthesized on this basis. The structure consists of plane layers of two dielectric materials alternatingly stacked in the direction of the incident wave, the materials having different refractive indexes and all layers of one material having the same thickness but not necessarily the same thickness as those of the other material. A filter for the submillimetric wave band is designed with air as one of the dielectric materials. Expressions are derived for the thicknesses of layers which will ensure given performance specifications. Figures 2; references: 3 Russian.

UDC 537.874.3.01

**Method of Refraction Calculations for Three-Dimensionally Nonhomogeneous Media**

*18600125h Moscow RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 33 No 5, May 88  
(manuscript received 10 Jan 86) pp 1063-1064*

[Article by F. B. Chernyy]

[Abstract] The trajectory of refracted light in three dimensionally nonhomogeneous media, and in only two-dimensionally nonhomogeneous ones as a special case, is calculated analytically with any desirable accuracy by transformation of the vector equation of geometrical optics describing Snell's law of refraction in one-dimensionally nonhomogeneous media into an equivalent system of two scalar first-order differential equations and integrating them. The method is demonstrated on refraction in the atmosphere, in which case that vector equation is projected onto the radius-vector through the center of the earth and onto the surfaces of spheres concentrically surrounding the earth within the atmosphere along the path of a light ray. References 8: 7 Russian, 1 Western (in Russian translation).

UDC 621.3.029.64.002.56

**Instrument for Analyzing Space Spectra of Microwave Electromagnetic Fields in Real Time**  
18600125j Moscow RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 33 No 5, May 88  
(manuscript received 24 Nov 86) pp 1097-1099

[Article by Yu. S. Obtemperanskiy]

[Abstract] An experimental prototype of an instrument for analyzing the space spectra of microwave electromagnetic fields has been built and tested, with a small body of a semiconductor material acting as a passive probe and almost fully reflecting incident radiation placed in the field without significantly distorting it. Its principal component is a cathode-ray scanner tube whose screen has a plane dielectric-semiconductor-metal sandwich structure. It includes also a parabolic antenna with radiator horn, a microwave oscillator, a low-frequency oscillator, a scanner control, a video monitor, an integrator, and a square-law detector. The probe is excited and scanned by the electron beam in the dielectric layer of the tube screen, this beam being modulated by the low-frequency oscillator so that the weight function of the probe is similarly modulated. A sinusoidal grid appears on the screen when the modulating frequency and the scanner sweep frequency are equal. The space spectrum of the field reflected by the probe is picked up by the antenna and transmitted through a directional coupler to the detector. The analyzer aperture is a circle 100 mm in diameter and one analysis is completed within 0.1 s. Figures 2; references: 4 Russian.

UDC 550.388:551.510.535

**Heating of Lower Ionosphere by Medium-Frequency and Low-Frequency Radio Waves**

18600163a Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 31 No 5, May 88 (manuscript received 30 Apr 86) pp 528-536

[Article by O. B. Smolyakova, Ye. V. Suvorov and M. D. Tokman, Institute of Applied Physics, USSR Academy of Sciences]

[Abstract] Heating of the ionosphere by radiation at frequencies covering the  $(1/100 - 2/3)f_H$  range ( $f_H$  - gyromagnetic frequency of electrons) from sources with radiation patterns ranging from quasi-isotropic to variously oriented highly directional ones during day and night is analyzed, as a basis for predicting its effects such as generation of combination-frequency signals. The altitudinal profile and the two-dimensional horizontal distribution of electron temperature perturbations are calculated on the basis of an ionosphere model which includes collisions and attendant energy absorption along the paths of waves. Heating in a vertical magnetic field by waves from a source with a "surface" radiation

pattern and in an oblique magnetic field by waves from a source with a "zenithal" radiation pattern is considered. The authors thank V. Yu. Trakhtengerts for interest and fruitful discussion. Figures 6; references 18: 15 Russian, 3 Western.

UDC 551.510.535:551.596.1

**Radioacoustic Sounding of Ionosphere**

18600163b Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 31 No 5, May 88 (manuscript received 21 May 86) pp 537-544

[Article by V. V. Plotkin and N. I. Izrayleva, Institute of Geology and Geophysics, Siberian Department, USSR Academy of Sciences]

[Abstract] Radioacoustic sounding of the ionosphere is considered, inasmuch as conditions for resonance Mandelshtam-Brillouin scattering of infralow-frequency (0.1-10 Hz) sound waves and medium-frequency or high-frequency radio waves can exist at ionospheric altitudes. Scattering of radio waves by inhomogeneities in the ionosphere by perturbations propagating through the latter at the velocity of sound is analyzed, such perturbation making the acoustic grating nonuniform and nonstationary with an attendant Doppler effect. Sound field calculations are made on this basis for an evaluation of the coefficient of resonant reflection of radio waves by such acoustic perturbations, its dependence on both power and frequency of the sound source, taking into account that the velocity of sound in the atmosphere depends also on the wind velocity component along the acoustic grating. Figures 4; references 11: Russian.

UDC 621.371.631.1:523.532

**Nonreciprocity of Radio Waves in Meteoric Radio Channel**

18600163c Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 31 No 5, May 88 (manuscript received 1 Jul 86) pp 545-549

[Article by A. N. Pleukhov, Kazan State University]

[Abstract] For a performance analysis of meteoric radio communication channels, the nonreciprocity of polarization characteristics in such a channel is evaluated as a special case of that in an ionospheric channel for radio waves. Considering that the ionosphere is a birefringent medium in which the electron concentration is smoothly nonuniform except where the difference between the two refractive indexes  $[n <]_{info} - n_e$  (for the ordinary wave and the extraordinary wave respectively) approaches or becomes zero, calculations are made by the method of geometrical optics in a system of coordinates in the plane of the wave vector, the geomagnetic field vector, and the direction of wave propagation. The phase nonreciprocity, changing with change of the electron concentration

as a consequence of the Faraday effect and "limiting polarization", is found to be small and not to exceed 20 deg in the worst case at meteoric frequencies. Measurements made along the meteoric channel between Kazan and Leningrad have yielded a 180 deg/s average and 270

deg/s maximum rate of change of phase nonreciprocity. The author thanks V. V. Sidorov for steady support, B. N. Gershman and Yu. Ya. Yashin for several helpful comments. Figures 2; references 9: 7 Russian, 2 Western (1 in Russian translation).

UDC 621.382.323

**Design of Low-Noise Microwave Amplifiers with Transistors**

*18600125g Moscow RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 33 No 5, May 88  
(manuscript received 19 Nov 86) pp 1036-1041*

[Article by G. V. Petrov]

[Abstract] An analytical engineering method is outlined for design of low-noise microwave amplifiers with

Schottky-barrier field-effect transistors, following a theoretical stability and noise analysis based on an equivalent four-pole active network and the corresponding transmission matrix. The procedure is somewhat different, but consists of 10 steps in each case, for calculating the performance parameters of amplifiers with potentially unstable transistors and those of amplifiers with addition of an absolutely stabilizing network. Numerical data pertaining to each kind are shown for illustration. Figures 2; references 7: 5 Russian, 2 Western.

UDC 656.25:621.311.6

**Electric Power Supplies for Centralized Switching and Signaling Posts in Large Railroad Stations**  
18600130c Moscow AVTOMATIKA TELEMEKHANIKA  
I SVYAZ in Russian No 6, Jun 88 pp 16-21

[Article by D. A. Kogan and Z. A. Etkin]

[Abstract] For the purpose of providing adequate electric power supply for centralized switching and

signaling posts in large railroad stations, the layout of the central distribution panel controlling all signal lights and relays is analyzed for loading conditions and power requirements. Each item is listed together with its nominal current and power ratings as well as its operating mode and operating period. Included are meters and instrument transformers mounted on the panel. The panel operates from a 3-phase 380/220 V liner on the a.c. side, drawing a current not higher than 15 A under peak loads and requires a 24 V supply for the d.c. side. Figures 3.

UDC 621.391.01

**Digital Filtration of Phase-Keyed Signals  
Minimizing Side Lobes of Indeterminacy Function  
Within Doppler Frequency Bank**

*18600125c Moscow RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 33 No 5, May 88  
(manuscript received 28 Oct 85, after correction  
15 Oct 86) pp 961-968*

[Article by P. M. Buzman]

[Abstract] A digital filter for phase-keyed signals is synthesized which operates according to an algorithm of matched filtration and minimizes the side lobes of the signal-filter mutual indeterminacy function within the Doppler frequency band. Minimizing the mean-square deviation of this function from its prescribed form at all points in the required set of frequency sections is shown to lead to an algorithm for calculating the references signal, namely its spectrum, from the correlation vector and the partitioned matrix relating this vector to the signal. Formation of multiphase pulse signals by discrete methods such as discrete fast Fourier transformation, much simpler than formation of stepwise or linearly frequency-modulated signal, is demonstrated on two examples. Numerical calculations are shown pertaining

to design and performance characteristics of a Hamming filter for PS (256,0,14) and PL (256,16,256) code sequences. Tables 4; references 16: 6 Russian, 10 Western (4 in Russian translation).

UDC 621.396.96.01

**Group Analysis of Systematic Errors of Radar  
Measurements**

*18600125d Moscow RADIOTEKHNIKA I  
ELEKTRONIKA in Russian Vol 33 No 5, May 88  
(manuscript received 23 May 86) pp 974-979*

[Article by V. V. Khutortsev]

[Abstract] The method of group analysis is applied to systematic errors of radar measurements, the target being regarded as a dynamic system and its state vector being described by a system of stochastic differential equations. Systematic target locating errors are tested for discernibility or indiscernibility on the basis of respective models, synthesis of the latter involving determination of corresponding vector functions. The procedure is demonstrated on the simple case of a target moving along a straight line. References 8: 7 Russian, 1 Western (in Russian translation).

UDC 621.382.323

**Analysis of Models for Adaptive Design of Submicron-Size Field-Effect Transistors**  
18600171c Kiev *IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA* in Russian Vol 31 No 6, Jun 88 (manuscript received 11 Sep 87) pp 64-72

[Article by V. V. Minakov, V. A. Moskalyuk, and V. I. Timofeyev]

**[Abstract]** Models of GaAs field-effect transistors with Schottky barrier are comparatively evaluated from the standpoint of suitability for adaptive design of such devices with submicron Schottky barrier, all available models falling essentially into four types with different degrees of precision each. Three types of deterministic models are the analytical ones based on approximate analysis of electron-transfer and field equations, the quasi-two-dimensional ones based on numerical solution of one-dimensional differential equations, and the two-dimensional ones based on numerical two-dimensional integration of fundamental macroscopic-scale equations including those of charge carrier dynamics along with both Poisson and continuity equations. Models of the fourth type, kinetic ones, are statistical and involve the Boltzmann equation along with the Poisson equation. Most practical for engineering purposes appear to be quasi-two-dimensional and kinetic models, which is confirmed by a complete design and performance analysis of a field-effect transistor with submicron Schottky barrier on the basis of such a model, kinetic models being in a sense also quasi-two-dimensional. Figures 3; references 14: 9 Russian, 5 Western.

UDC 681.513.7

**Problems and Methods of Adaptation in Computer-Aided Design of Electronic Equipment**  
18600171b Kiev *IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA* in Russian Vol 31 No 6, Jun 88 (manuscript received 29 May 87) pp 54-59

[Article by A. M. Bershadskiy]

**[Abstract]** Adaptation in computer-aided design systems and particularly in integrated ones for design of electronic equipment is considered, the purpose of adaptation being to optimally design equipment for indeterminate initial and variable subsequent operating conditions. Adaptation in such a design system involves 10 procedures corresponding to 10 informational links. These are adaptation of the problem to the user (optimization criteria) and of the user to the problem (data analysis), adaptation of the computer to the problem (problem identification and program search) and of the problem to the computer (problem formulation and decomposition), adaptation of the computer to the user (selection of operating mode) and of the user to the

computer (learning), and adaptation of the software to the design object (structural or parametric adaptation), to the database, to the hardware, and to the user. These adaptation procedures involve either recognition and classification of objects or adaptive selection of alternatives, both methods being commonly used at the present time. Figures 2; references 18: 17 Russian, 1 Western.

UDC 681.513.6

**Problem-Oriented Adaptation in Computer-Aided Design Systems**

18600171a Kiev *IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA* in Russian Vol 31 No 6, Jun 88 (manuscript received 11 Dec 87) pp 5-22

[Article by V.P. Sigorskij]

**[Abstract]** Adaptive problem orientation of computer-aided design systems is overviewed starting from fundamentals, the two possible schemes of their organization being the alternative one and the imperative one. Both schemes can be combined for adaptive problem orientation so that the advantages of each will be realized, according to theoretical, empirical, or heuristic criteria. In the alternative scheme all system modules are programmed for solving a hypothetical problem of maximum possible complexity with rigid deductive logic. In the imperative scheme a set of special-purpose program modules is stored in the computer memory for solving typical most common practical problems with flexible inductive logic, any inadequacy of these modules for solution of a specific problem being overcome by retrieving supportive programs from an external memory. Thus is organized adaptation of numerical analysis, involving preferably algorithmic rather than event-wise or structural decomposition for maximum computer time economy, also adaptation of mathematical models especially helpful for circuit design and multilevel hybrid adaptive simulation. Adaptation of computer-aided design systems presents a problem itself, a scientific-technical problem requiring a linguistic as well as algorithmic and informational solution. Adaptation is closely associated with control, automatic adaptive control being a stepping stone toward raising the artificial intelligence of computer-aided design systems to the level of "artificial brains." References 100: 88 Russian, 12 Western (9 in Russian translation).

UDC 621.391.8:681.31

**Conveyor Structures for Digital Signal Processing and Their Computer-Aided Simulation**

18600145d Moscow *RADIOTEKHNIKA* in Russian No 5, May 88 (manuscript received 26 Jul 87) pp 27-30

[Article by A. M. Movshovich and N. K. Yakovleva]

**[Abstract]** Digital processing of signals by conveyor structures is considered, such a structure combining an array of conveyor registers and adders with summators

and shift registers. An algorithm is constructed which facilitates not only the synthesis of such structures but also their computer-aided simulation. Readings of a signal are assumed to appear at the input of the structure after quantization indeterminacy of their access to it being taken into account. With numbers represented in a

complementary code, the algorithm provides for such common operations as multiplication by a constant coefficient  $2^{-k}$ , multiplication by an arbitrary constant coefficient  $c$ , and addition of two readings with different weight factors. Figures 5; references 3: 2 Russian, 1 Western.

UDC 534.84:791.45

**New Approach to Evaluation of Acoustics in Auditorium Such as Oktyabr Movie Theater in Moscow**

*18600127a Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 5, May 88 pp 10-14*

[Article by Yu. N. Grebeshkov and T. N. Prokofyeva, All-Union Scientific Research Institute of Cinematography]

[Abstract] Reconstruction of auditoria such as the Bolshoi auditorium in the Oktyabr movie theater (built in the 1960's) for alternate use as concert halls is proposed,

a new approach to improving not only the auditorium acoustics but also aesthetically the ceiling architecture having been developed at the All-Union Scientific Research Institute of Cinematography. Acoustic measurements in an existing structure for purposes of its redesign are, according to this new method, based on the theory of sound diffraction. Simple relations have been established for calculating the scattering characteristics of surfaces and the diffusion level of acoustic fields from the readings of incident and reflected sound signals. Existing radiation patterns are plotted on this basis and then modified to specifications as basis for structural-geometrical redesign. Figures 5; tables 2; references 7: 6 Russian, 1 Western.

**Setup for Bonding Optical Fibers**  
81442829 Moscow VESTNIK SVYAZI in Russian  
No 4, Apr 88 pp 47-49

[Article by A. I. Rybyanets and V. A. Tikhonov, engineers, under the "From Science to Production" rubric: Setup for Bonding Optical Fibers"; first paragraph, VESTNIK SVYAZI introduction]

[Text] Beginning in 1987 the USSR Ministry of the Communications Industry organized the series production of the model KSS-111 setup for bonding optical fibers. The setup includes production equipment and tools for preparing optical cable for bonding and for bonding KKG-type quartz gradient optical fibers, which meet specifications TKHO.835.093 TU and TU 16.705.452-86. The setup (Figure not reproduced.) consists of devices for bonding optical fibers, an RO-1 device for cutting optical cable sheaths, an SO-2 tool for removing an optical cable's protective sheathing, an IR-1 tool for splitting optical cable, and auxiliary tools. A setup costs 6,900 rubles.

The preparation of the optical cable for bonding begins with the removal of the outer sheathings. This is done by using a model RO-1 tool (Figure not reproduced.), which makes transverse, longitudinal, and (when necessary) spiral scores. The required length of cable is laid in the roller groove, and a button is pressed to make the knife cut into the cable sheathing the specified depth. An arm is placed in the position specifying the type of score.

A model SO-2 tool is then used to remove the protective sheathings. First, special side knives are used to remove the modular tube. Next, profiled knives with a calibrated opening are used to remove the polyamide coating. Finally, thin polymer filaments (lines) enclosing the fiber are used to help remove the layer directly adjacent to the fiber (Figure not reproduced.). To accomplish this, a lever is pressed to score the fiber's protective polyamide sheathing. The protective sheathing is removed by pulling the fiber (which is being held by a clamp) out of the tool. The fiber is fed into the bushing opening and is clamped by a line by turning a diaphragm. The fiber's inner coating is removed by carefully pulling it out of the tool. To keep the line from breaking, the coating is not completely removed (when necessary, the removal of the fiber's protective and inner coatings can be combined into a single operation). If the line breaks, the tool is serviced.

The fiber is scored by using a model IR-1 tool and the controlled break method. First a cutter makes a flaw, and then the fiber is bent and stretched apart (Figure not reproduced.). The top of the tool is pressed down to make the flaw in the fiber. The top is then released. The cutter is raised, and the fiber remains pressed to the plate. The fiber is broken by bending the base sharply. When a cutter fails, it is replaced.

Besides these special tools, the setup also includes a proportioning pump to feed alcohol to wipe the fiber clean and auxiliary all-purpose tools such as scissors, a tweezer, etc.

The prepared optical fibers are joined by an electric arc in a model KSS-111 alignment unit and bonding setup after having first been laid in V-shaped grooves and fixed in place by magnetic catches. The movable spring-loaded stops in the clamps and the design of the V-shaped grooves make it possible to fix different-diameter fibers (from 0.25 to 0.9 mm, depending on their protective coating).

The left fiber clamp may be moved in three coordinates and used to align fibers relative to one another and to shift them during manual bonding. The right clamp may only be moved along the fiber's axis and can shift the fibers in an automated mode on account of the thermal engine.

A model MIR-3 microscope, which is mounted on a carriage, is shifted from one extreme position to the other, which makes it possible to view the pair of fibers being aligned sequentially in two mutually perpendicular planes with a magnification of no less than 60 times. A light source with a diffuser is mounted in the electrode unit and provides a contrast image of the fibers in the microscope's field.

Two tungsten electrodes with bilateral grinding are mounted in the electrode unit, and the electrodes' position is regulated. The electrode unit may be moved in three coordinates, which makes it possible to place the electrodes in the plane of the fibers being aligned as well as symmetrically relative to the fibers.

The bonding unit's electrode circuit forms an electric discharge and also makes it possible to control the following parameters: the fusion and bonding current, the arcing time in a fusion and bonding mode, and the shift speed. Furthermore, in an automated mode, a thermal engine helps effect the timely shift of the fibers during bonding.

Included in the KSS-111 is a subassembly to protect the optical fibers' bonding site by heat shrinkage. It consists of a heating element and a special attachment with grips for the fiber.

As its feed source the model KSS-111 setup can have an accumulator or other direct current source with a voltage of 12 plus or minus 2 V and with a load current of no less than 4 A.

The setup is designed for use in booths, under overhangs, and in underground cable conduit systems at an ambient air temperature ranging from -10 to +40 degrees C and relative humidity of no more than 98 percent at an ambient air temperature of +20 degrees C.

When its operator has the appropriate experience and observes its operating rules, the KSS-111 joins gradient optical fibers with losses of no more than 0.2 dB.

A setup of components to protect the bonding site [KDZS] that does not include a KSS-111 is used for subsequent finishing of the site at which the optical fiber has been bonded. The setup is ordered separately. Before the bonding takes place, the setup is slipped onto the left

optical fiber. After the fibers have been bonded, the setup is moved into the bonding area and transferred to area where the heating element is located for shrinkage.

The KSS-111 setup is currently being widely used in the construction of fiber optic communications lines.

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UDC 621.382.82.001

**Adaptive Generalized Models of Digital Integrated Microcircuits**

*18600171d Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA in Russian Vol 31 No 6, Jun 88 (manuscript received 21 Sep 87) pp 72-78*

[Article by V.I. Zubchuk, I.Ya. Yevtukhova, and O.I. Mikulchenko]

[Abstract] The procedure for constructing adaptive generalized models of digital integrated microcircuits is outlined, a generalized model also called a macromodel covering a class of devices and taking into account their fabrication technology. The procedure involves determining the functional relations which characterize the dependence of input currents, driving currents, and output currents on the corresponding three external voltages and on the corresponding three sets of circuit parameters. The procedure is demonstrated on AND, NAND gates (lowest of  $m$  input voltages dominant) and OR, NOR gates (highest of  $m$  input voltages dominant) with TTL(Sch) structure and with CMOS structure. It has been programmed for computer-aided design and extended for constructing generalized models of combinational logic, triggers, registers, counters, and other devices, apriori adaptation significantly shortening the computer time for solution of ill-conditioned problems. Figures 6; references 4: 3 Russian, 1 Western (in Russian translation).

UDC 658.011.56:681.3

**Adaptive Components of Software in Computer-Aided Design Systems for Very-Large-Scale Integration**

*18600171e Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA in Russian Vol 31 No 6, Jun 88 (manuscript received 10 Sep 87) pp 84-86*

[Article by A.A. Budnyak and A.P. Artemenko]

[Abstract] Computer-aided design of VLSI circuits for operation under continuously varying conditions is considered, problem adaptation in such design systems requiring inclusion of alternative subsystems, models, procedures, and algorithms in the software. The adaptive components of software in such design systems include a dispatcher, a database control, an interactive monitor, a synthesizer of translators and interfaces, means of automatic learning, and access to expert assistance. The dispatcher estimates the criteria for determining the ranges of preferability of alternatives and executes the adaptations. Figures 1; references 5: 4 Russian, 1 Western.

UDC 621.38.002

**Imperative and Alternative Adaptation of Procedures for Selecting Optimum Variants of Electronic Apparatus**

*18600171f Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA in Russian Vol 31 No 6, Jun 88 (manuscript received 14 Sep 87) pp 86-88*

[Article by V.Ye. Suchik, N.A. Krupa, and A.V. Leonchenkov]

[Abstract] Computer-aided design of electronic apparatus is considered, the design procedure including discrete selection of optimum variants. Imperative adaptation used for such a selection and involving apriori selection of the most adequate among competing models on the basis of its input data is very effective and versatile, but has drawbacks which are excessive loss of computer memory capacity and, in the case of an unsatisfactory final selection, no means of utilizing intermediate results. These drawbacks can be eliminated by combining it with alternative adaptation. The procedures for such a discrete selection of optimum variants on the basis of both adaptation principles have been programmed in FORTRAN language for a Yes computer and included as a subsystem in the computer-aided design system for electronic apparatus. Figures 2; tables 2; references: 2 Russian.

UDC 621.382

**Synthesis of Adaptive Electrical Models of Transistor Structures by Methods of Numerical Nonstationary Simulation**

*18600171g Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA in Russian Vol 31 No 6, Jun 88 (manuscript received 23 Oct 87) pp 89-91*

[Article by A.N. Bubennikov and A.V. Chernyayev]

[Abstract] Adequate adaptive electrical models of transistor structures in both one-dimensional and two-dimensional approximations were synthesized by the numerical finite-differences method of nonstationary simulation along with stationary physical and topological simulation of a BESM-6 high-speed computer. Each of the two models identifies static and dynamic characteristics of a transistor structure, relates these characteristics to the technological parameters of transistor manufacture, and accounts for the dependence of transient processes in a transistor circuit on the impurity concentration profiles in the transistor structure. These models are synthesized in hierarchical series, from the most complex version to the simplest one. As an illustrative example are considered such models of four transistor structures for common-base amplifiers operating from the same power supply: basic transistor structure, one with "offset" buried collector, one with weakly doped base, one with strongly doped base. Figures 2; references 4: 2 Russian, 2 Western.

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